Annexure E

IESC (2024) information guidelines checklist

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Table E.1 IESC (2024) information guidelines checklist

Assessment category	Section addressed
Description of the proposed project	
General	
• Provide a regional overview of the proposed project area, including a description of the geological basin, coal resource, surface water catchments, groundwater systems, water-dependent assets (including terrestrial and aquatic GDEs), and past, present and reasonably foreseeable coal mining and CSG developments.	Sections 4, 5 Annexure A (Section 2) Annexure B (Section 2) Annexure C
• Describe the proposal's location, purpose, scale, duration and disturbance area, and the means by which it is likely to have a significant impact on water resources and water-dependent assets.	Sections 1, 2, 6 HVO North PER (EMM 2026a) HVO South PER (EMM 2026b)
• Assess the frequency (and time lags, if any), location, volume and direction of interactions between water resources, including surface water/groundwater connectivity, inter-aquifer connectivity and connectivity with sea water.	Sections 4, 5 Annexure A (Section 2) Annexure B (Section 2)
Regulatory context	
• Describe the statutory context, including information on the proposal's status within the regulatory assessment process and any applicable water management policies or regulations.	Sections 1, 3 Annexure B (Section 1.6)
• Describe how potentially impacted water resources are currently being regulated under state or Commonwealth law, including whether there are any applicable standard conditions.	Sections 1, 3 Annexure B (Section 1.6)
• Describe existing water quality guidelines, environmental flow objectives and other requirements (e.g. water planning rules) for the surface water catchments and groundwater basins within which the development proposal is based.	Sections 3, 4 Annexure B (Section 1.6, 2.5)
• Describe public health, recreation, amenity, Indigenous, tourism and/or agricultural values for each water resource, and the plans relevant to their management and protection.	Sections 4.4.4, 4.6.6
Groundwater context	
• Describe and map the geology at an appropriate level of horizontal and vertical resolution, including:	Sections 4.5, 4.6, 5
– Definition of the geological sequence(s) in the area, with names and descriptions of the formations and accompanying surface geology, cross-sections and any relevant field data.	
– Identification of hydrogeological sequences and characteristics.	
• Define and describe or characterise significant geological structures (e.g. faults, folds, intrusives) and associated fracturing in the area and their influence on groundwater – particularly groundwater flow, discharge or recharge:	Section 4.5
– Provide geological maps appropriately annotated with symbols that denote fault type, throw and the parts of sequences the faults intersect or displace (e.g. Murray and Power 2021).	
– Include discussion of how the faults potentially influence regional-scale groundwater conditions.	
• Describe the likely recharge, discharge and flow pathways for all hydrogeological units likely to be impacted by the proposed development:	Sections 4.6, 5 Annexure A (Section 2)
– Identify current stressors, including impacts from any currently approved projects.	

Assessment category	Section addressed
• Describe the existing water quality of all aquifers in the project area:	Section 4.6
– Where groundwater is to be used for a given purpose such as irrigation, compare the data with relevant guideline values (ANZG 2018) and regional and local water quality objectives.	
Surface water context	
• Describe the watercourses, standing waters and springs across the site, including:	Section 4.4 Annexure B (Section 2)
– Drainage patterns and key surface water and floodplain features.	
– Hydrological regimes (especially ecologically relevant components such as durations, timing and frequency of periods when no surface water is present).	
– Current stressors, including impacts from any currently approved projects.	
• Describe the existing water quality of surface waters potentially impacted by the proposed development.	Section 4.4.3 Annexure B (Section 2.5)
– Include comparison to relevant default guideline values (ANZG 2018) and regional and local (or site-specific) water quality objectives.	
Ecological context	
• Describe the ecological water-dependent assets in and near the proposed development area, including:	Section 4.8 Annexure C Umwelt 2026a and 2026b
– Water-dependent fauna and flora and their habitats, including GDEs (see Doody et al. 2019).	
– Their current condition and environmental values.	
– Stressors that currently affect each ecological water-dependent asset, including stressors that alter the quantity and/or quality of water required by each asset in and near the proposed development area.	
Environmental impact assessment	
General	
• Describe the intensity, duration, magnitude, timing and geographic extent of each potential impact, specifying the impact's significance and consequences, especially on the environmental condition and human values of each water resource.	Sections 6, 7, 8, 9, 10 Annexure A (Section 5.3) Annexure B (Section 6) Annexure C
• For proposed expansions or modifications, distinguish potential impacts from those of the existing project, and include the likely contribution of the proposed expansion to potential cumulative impacts.	Sections 7, 8, 9, 10 Annexure A (Section 5.3)
• Assess the significance of each impact with reference to the range of system behaviour found under pre-development conditions and natural environmental and climatic variability.	Sections 7, 8, 9, 10 Annexure A (Section 5.3) Annexure B (Section 6) Annexure C
Risk-based assessment	
• Identify and assess all potential environmental risks to water resources and water-related assets, and their possible impacts. In selecting a risk-assessment approach, consideration should be given to the complexity of the project and the probability and potential consequences of the project's impacts.	Sections 6, 11, 12.8

Assessment category	Section addressed
• Describe the consultation with relevant stakeholders and regulators about the likely risks to water resources and water-related assets. This initial engagement should include agreement about the nature of the action, which assets (including water resources) may be impacted, and the likely sources of impacts and the receptors that may be affected.	Section 2.3
• The risk assessment should include a systematic and evidence-based assessment of:	
– The sources of environmental impacts in the project area.	Sections 6, 11
– The exposure pathways by which impacts may be transferred from these sources to water resources (receptors), presented as one or more impact pathway diagrams based on ecohydrological conceptualisation.	Section 6.4
– The likely response of each receptor, especially when the impact(s) may be severe and likely to cause irreversible damage (posing a high risk)	Sections 6.4, 11
– 'Hot spots', or areas in the project area (e.g. where vulnerable receptors occur close to impact sources) where risks are especially high.	Section 6.4
– 'Hot moments', or periods during and after the project (e.g. when activities are likely to generate major impact) when risks are especially high.	Section 6.4
• Specify where and how each risk can be avoided or mitigated (or, as a last resort, requires appropriate offsets and/or a conservation payment), and:	Sections 2, 6, 11, 12 Umwelt 2026a and 2026b Annexure C
– Provide evidence (preferably from equivalent activities and regions) for the feasibility and effectiveness of mitigation or offset methods.	Sections 2, 4.6, 8, 9, 12
– Describe how monitoring will be able to demonstrate the effectiveness of the mitigation measures.	Section 12 Annexure B (Section 7) Umwelt 2026a and 2026b
• Describe the risks of potential cumulative impacts of all past, present and reasonably foreseeable actions and activities that are likely to impact on water resources, including from multiple stressors arising from the proposed action.	Sections 6.7, 7, 8, 9 Annexure A (Section 5.3) Annexure B (Section 6.8) Annexure C
• Specify all sources of uncertainty in the assessments of each risk and describe how information has been and will be collected to reduce this uncertainty.	Sections 4, 6, 11, 12 Annexure A Annexure B
• Investigate relevant context for the risk assessment, such as bioregional assessments, Commonwealth and state water resource plans (e.g. Murray–Darling Basin Plan, Hunter River Salinity Trading Scheme) and state processes such as those that apply in the Surat Cumulative Management Area and the Commonwealth's Joint Industry Framework on Coal Seam Gas.	Section 3, 6, 11.1 Annexure C
• Assess residual risks remaining after the implementation of the proposed mitigation and management options, to determine whether these effectively reduce risks to an acceptable level based on the identified environmental objectives.	Section 12.8 Annexure C
Modelling of water storage and movement	
• Incorporate causal mechanisms and pathways identified in the risk assessment (e.g. IPDs) in conceptual and numerical modelling. Use the results of these models to update the risk assessment.	Sections 6, 11, 12 Annexure A Annexure B Annexure C

Assessment category	Section addressed
• Provide a detailed description of all analytical, numerical and conceptual models used, and any methods and evidence (e.g. expert opinion, analogue sites) employed in addition to modelling.	Sections 6.5, 6.8 Annexure A Annexure B
• Explain the conceptualisation of the system(s), including multiple conceptual models if appropriate. Describe the data and information, including field data, on which the models are based; all key assumptions; and model limitations and their consequences.	Sections 4, 5 Annexure A Annexure B (including various attachments)
• Calibrated models require adequate monitoring data from either the project area or sites representative of local conditions, ideally with calibration targets related to model predictions. Summarise the extent to which parameterisation is consistent with expectations based on literature values, outcomes of field or laboratory investigations, or with values obtained by calibration in similar nearby applications.	Annexure A Attachments to SWIA (Annexure B)
• Where possible, verify models by using past and/or existing site monitoring data that were not used for calibration.	Annexure A
• Assess the quality of, and risks and uncertainty inherent in, the data used to establish baseline conditions and in modelling, particularly with respect to predicted potential impact scenarios. Identify key gaps in data and knowledge and describe how they can be addressed.	Annexure A Annexure B
• Describe the various stages of the proposed project (construction, operation and rehabilitation) and their incorporation into the model. Provide predictions of changes and recovery in each water resource for the life of the project and beyond, including an assessment of the impacts of climate change where applicable, and cumulative impacts.	Sections 6, 7, 8, 9, 10 Annexure A Annexure B (including various attachments)
• Provide a program for reviewing and updating models as more data and information become available, including reporting requirements.	Section 12 Annexure B (Section 7) HVO Water Management Plan
Groundwater	
• Undertake groundwater modelling in accordance with the *Australian groundwater modelling guidelines* (Barnett et al. 2012), including independent peer review.	Sections 6, 8 Annexure A Annexure F
• Describe each hydrogeological unit as incorporated in the groundwater model, including the thickness, storage and hydraulic characteristics, and hydraulic linkages between units, if any.	Sections 4, 5, 6 Annexure A (Section 2)
• Describe the existing recharge/discharge pathways of the units and the changes that are predicted to occur upon commencement, throughout, and after completion of the proposed project.	Sections 4, 5, 6 Annexure A (Section 2, 3)
• Select and justify appropriate boundary conditions across the model domain to enable a comparison of groundwater model outputs to seasonal field observations.	Annexure A (Section 3)
• Where possible, calibration should incorporate measurements of both potentiometric head (or pressure) and flux, such as measured mine inflows or measured discharges to streams or springs.	Annexure A (Section 4)
• Undertake sensitivity analysis of boundary conditions and hydraulic and storage parameters, and justify the conditions applied in the final groundwater model. Where the interaction between surface water and groundwater is important, parameters describing their connectivity, such as riverbed conductance, should be assessed.	Annexure A (Section 4)
• Assess the potential impacts of the proposal, including how impacts are predicted to change over time and any residual long-term impacts. Consider and describe:	Section 8 Annexure A (Section 5)

Assessment category	Section addressed
– Any hydrogeological units that will be directly or indirectly dewatered or depressurised (including lateral effects), interactions between water resources (inter-aquifer connectivity), and connectivity with sea water.	Section 8 Annexure A (Section 5)
– The magnitude, extent and change over time of drawdown/mounding, including the time for post-development equilibrium to be reached.	Sections 8, 10 Annexure A (Section 5)
– The extent of impacts on surface water/groundwater connectivity, water-dependent assets, flow direction and surface topography, including resultant impacts on the groundwater balance.	Sections 8, 9, 10 Annexure A (Section 5)
– The potential range of drawdown at each affected bore, and clearly articulate the spatial and temporal scales of impacts on other water users.	Section 8 Annexure A (Section 5)
– The potential impacts on hydraulic and storage properties of hydrogeological units, including changes in storage, potential for physical transmission of water within and between units, and estimates of likelihood of leakage of contaminants through hydrogeological units.	Sections 8, 10 Annexure A (Section 5)
– The possible fracturing of and other damage to confining layers.	Not applicable, given open cut mining Annexure A
• Undertake an uncertainty analysis of key predictive outputs (i.e. quantities of interest as per Peeters and Middlemis 2023).	Section 6.5 Annexure A (Section 5)
• For each relevant hydrogeological unit, describe the proportional increase in groundwater use and impacts as a consequence of the proposed project, including an assessment of any consequential increase in demand for groundwater from towns or other industries resulting from associated population or economic growth due to the proposal.	Local increase in groundwater use of the alluvial aquifer (outside HVO use/interaction) or Permian groundwater is not expected- towns considerable distance downstream. The Hunter River alluvial water source is the dominant aquifer with social, community and cultural values due to water quality; however there are no additional water licences available within the water source for new users.
Surface water	
• For flood estimation, use methods in accordance with the most recent publication of *Australian rainfall and runoff* (Ball et al. 2019); for rainfall-runoff modelling, use methods as outlined by Vaze et al. (2012); and for the modelling of water and salt balances related to mine water management, refer to the water accounting framework (Minerals Council of Australia 2022). Consider the relevance of regional information (see Nathan and McMahon 2017). It is expected that flood risks are assessed for annual exceedance probabilities of at least 1% (i.e. 1 in 100); however, in many instances it may be necessary to estimate floods with rarer annual exceedance probabilities, such as 0.1% (i.e. 1 in 1,000), or events which have a negligible chance of being exceeded (the probable maximum flood).	Section 6.5 Annexure B (including Attachments C, D, E and F to SWIA)
• Describe all potential impacts of the proposed project on surface waters. Include a clear description of the impact on the resource and the likelihood and consequences of the impact. Consider:	
– Impacts on streamflow under the full range of flow conditions, focusing on metrics that are most relevant to ecologically important flow components (e.g. the timing, frequency and variability of zero- and low-flow days, low flows exceeded 90% of the time, flow pulses related to ecological processes such as spawning and migration) as well as those relevant to water supply reliability.	Sections 7.3, 9.3 Annexure B (including Attachment A of the SWIA) Annexure C

Assessment category	Section addressed
– Impacts associated with surface water diversions.	Not applicable, no new creek diversions proposed
– Impacts on water quality, including consideration of mixing zones (i.e. areas downstream of discharges where water quality objectives do not apply) if applicable.	Section 7.4 Annexure B
– The quality, quantity and ecotoxicological effects of operational and emergency discharges of water (including saline water) at different flows, and the likely impacts on water resources and water-dependent assets.	Sections 7.4, 9.2 Annexure B Annexure C
– Landscape modifications such as subsidence, voids, post-rehabilitation landform collapses and on-site earthworks (including disturbance of acid-forming or sodic soils, roadway and pipeline networks), and describe how these could affect surface water flow, surface water quality, erosion and sedimentation within and downstream of the project area.	Sections 2, 6, 11 Mine Closure and Rehabilitation Strategy Noting subsidence is not applicable as mining at the HVO Complex is open cut.
• Identify processes to determine surface water quality guidelines and quantity thresholds which incorporate seasonal variation but provide early indication of potential impacts on assets.	Sections 2.1, 4.4 HVO Water Management Plan Annexure B
• Assess the risks of flooding (including channel form and stability, water level, depth, extent, velocity, shear stress and stream power) and the impacts of flooding on water-dependent assets, project infrastructure and the final project landform.	Section 1 Annexure B
• Identify and evaluate the quality (including uncertainty) and other aspects of streamflow and other hydrological data, such as proximity to rainfall stations and stream gauges, duration of data records, and whether missing data have been patched.	Annexure B
• Develop and describe a plan for ongoing ecotoxicological monitoring, including direct toxicity assessment of discharges to surface waters where appropriate.	Section 12.5, 12.5.4 River red gum rehabilitation and restoration strategy HVO Water management plan
Ecology	
• Assess direct and indirect impacts of the proposed project (e.g. landscape modifications such as voids, on-site earthworks, roads, pipelines and stream-channel diversions, mine dewatering, operational releases of water affected by mining or CSG activities) on water-dependent ecological assets such as flora and fauna dependent on surface water and groundwater, including springs and other GDEs.	Sections 6, 8, 9 Annexure C MNES reports (Umwelt 2026a and 2026b)
• Using suitable IPDs based on an initial ecohydrological conceptualisation, describe the likely cause–effect mechanism(s) from impact sources to each receptor. Consider:	Section 6.4
– Direct and indirect impacts on aquatic and water-dependent terrestrial populations, species and communities, including those whose water dependence may not yet be demonstrated (e.g. terrestrial GDEs)	Section 9 Annexure C
– How predicted alterations of the hydrological regime (especially ecologically relevant components such as durations, timing and frequency of periods when no surface water is present; and timing and duration of overbank flooding) in standing and flowing waters might affect each water-dependent ecological asset in and near the project area at a range of temporal scales (e.g. seasonal, annual, decadal).	Sections 7, 9 Annexure B Annexure C
– How predicted alterations of water quality (including water temperature and salinity) might affect each water-dependent ecological asset in and near the project area at a range of temporal scales (e.g. seasonal, annual, decadal).	Sections 7, 9 Annexure B Annexure C

Assessment category	Section addressed
– How interactions of predicted alterations of quantities and quality of surface water and/or groundwater might affect each water-dependent ecological asset in and near the project area at a range of temporal scales (e.g. seasonal, annual, decadal).	Sections 7, 8, 9 Annexure C
– The likely cumulative impacts of the proposed development with those of pre-existing water-intensive activities and other drivers such as climate change.	Sections 7, 8, 9, 10.6 Annexure C
• For ecological risk-based assessment, evaluate the likelihood and consequences of the impacts and their pathways based on the impact assessment and IPDs (outlined above), particularly for highly valued receptors and in 'hot spots' where impacts are especially likely. Consider that some impacts may be especially likely during particular phases of the proposed development, and describe these 'hot moments' and their associated risks to water-dependent ecological assets.	Sections 6.4, 9 Annexure C
Water and salt balances	
• Describe the proposed development's water requirements and on-site water management infrastructure, including modelling to demonstrate the infrastructure's adequacy under a range of potential climatic conditions, including extremes associated with predicted climate change.	Section 7.2 Annexure B
• Provide salt balance modelling that includes stores and the movement of salt between stores, and takes into account seasonal and long-term variation.	Annexure B
• Indicate the vulnerability to contamination (e.g. from salt production and salinity) of, and the likely impacts of contamination on, the identified water-dependent ecological assets.	Sections 6.4, 7.4, 9
• Identify how produced water, brine and waste from water treatment plants that are stored on site during operations will be managed and disposed of after operations cease, where applicable.	Section 2.2 Annexure B
• Provide a quantitative site-level water balance model describing the total water supply and demand under a range of rainfall conditions and allocations of water for mining activities (e.g. dust suppression, coal washing), including all sources and uses.	Section 7.2 Annexure B
• Provide estimates of the quality and quantities of operational discharges under dry, median and wet conditions, potential emergency discharges due to unusual events, and the likely impacts on water-dependent ecological assets.	Section 7.2 Annexure B
Geochemistry (e.g. acid-sulfate soils)	
• Identify the presence and potential exposure of acid-sulfate soils (including from oxidation arising during groundwater drawdown) and other geochemical sources of contaminants and extreme pH.	Sections 4.7, 6, 8.5 Annexure D
• Identify the presence and volume of potentially acid-forming waste rock and fine-grained amorphous sulfide minerals and describe coal reject/tailings material and potential exposure pathways.	Section 4.7 Annexure D
• Identify other sources of contaminants, such as high metal concentrations in groundwater, leachate generation potential and seepage paths. Where identified, quantify potential contaminants in coal rejects and leachate with appropriate testing methods.	Section 4.7 Annexure D
• Assess the potential impacts on and risks to water-dependent ecological assets, taking into account dilution factors and including solute transport modelling where relevant; representative and statistically valid sampling; and appropriate analytical techniques.	Sections 4.7, 8.5, 10.5 Annexure D (Solute transport modelling not considered necessary)
• Describe proposed measures to avoid or mitigate risks of impacts on water resources, water users and water-dependent ecosystems and species, and provide evidence for the likely feasibility and effectiveness of these measures. Specify handling and storage plans for acid-forming materials (e.g. co-disposal, tailings dam, encapsulation) to reduce their risks to water-dependent ecological assets.	Sections 4.7, 12 Annexure D

Assessment category	Section addressed
Subsidence	
• Provide predictions of subsidence impacts on surface topography, water-dependent assets, groundwater (including enhanced connectivity between aquifers) and the movement of water across the landscape (see CoA 2014b; CoA 2014c). – Consider multiple methods of prediction and apply the most appropriate method. – Consider the limitations of the applied method, including the adequacy of empirical data and site-specific geological conditions, and justify the selected method. – Consider the limitations of the applied method, including the adequacy of empirical data and site-specific geological conditions, and justify the selected method.	Not applicable
• Describe subsidence monitoring methods, including the use of remote or on-ground techniques, and explain the predicted accuracy of such techniques.	
• Assess both conventional and unconventional subsidence. For project expansions, provide an evaluation of past or current effects of geological structures on subsidence and the implications for water resources and water-dependent assets.	
• Consider geological strata and their properties (strength/hardness/fracture propagation) in the subsidence analysis and/or modelling. Anomalous and near-surface ground movements with implications for water resources and compaction of unconsolidated sediment should also be considered.	Not applicable
Chemicals	
• List the chemicals proposed for use in drilling and hydraulic stimulation of CSG production bores, including: – Proprietary names (trade names) of compounds (e.g. fracturing fluid additives) being produced. – Chemical names and CAS numbers of each additive used in each of the fluids. – General purpose and function of each of the chemicals used. – Mass or volume of each of the chemicals proposed for use and its maximum concentration (mg/L or g/kg). – Ecotoxicology. – Any material safety data sheets for the chemicals or chemical products used.	Not applicable
• The use of drilling and hydraulic fracturing chemicals should be informed by appropriately tiered deterministic and/or probabilistic hazard and risk assessments, based on ecotoxicological testing consistent with Australian Government testing guidelines (see CoA 2012; NRMMC-EPHC-NHMRC 2009).	Not applicable
• Chemicals for use in drilling and hydraulic fracturing must be identified as being approved for import, manufacture or use in Australia (i.e. listed on the Australian Inventory of Industrial Chemicals; see CoA 2020b).	Not applicable
• Propose waste management measures (including salt and brines) during both operations and legacy after closure.	Not applicable
Drilling and hydraulic stimulation	
• Describe the scale of fracturing (number of wells, number of fracturing events per well), types of wells to be stimulated (vertical versus horizontal), and other forms of well stimulation (e.g. cavitation, acid flushing).	Not applicable
• Describe proposed measurement and monitoring of fracture propagation, and specify associated uncertainties and challenges.	Not applicable

Assessment category	Section addressed
• Identify water source(s) for drilling and hydraulic stimulation, and specify the volumes of fluid and mass balance (quantities/volumes).	Not applicable
• Describe the rules (e.g. water sharing plans) covering access to each water source to be used for drilling and hydraulic stimulation, and how the project proposes to comply with them.	Not applicable
• Quantify and describe the quality and toxicity of flowback and produced water and how it will be treated and managed.	Not applicable
• Assess the potential for inter-aquifer leakage or contamination, and describe the risks to water-dependent assets if such leakage or contamination occurs.	Not applicable
Closure, rehabilitation and post-development final landforms and voids	
• Describe the timing and processes planned for cessation of operations and the closure of the development, particularly any risks of impacts on water-dependent assets that may arise during this phase (e.g. when dismantling and removing infrastructure). Explain how such risks will be avoided or mitigated.	Sections 2.2, 6.4, 10 Mine Closure and Rehabilitation Strategy
• If appropriate, qualitatively describe the various final landform options that were considered and their likely legacy impacts on water resources. This context will be useful for justifying the choice of the proposed final landform and how it avoids or mitigates risks of legacy impacts on water resources.	Mine Closure and Rehabilitation Strategy
• Ideally, describe how land disturbed by mining activities will be progressively rehabilitated to a safe and stable landform that does not cause environmental harm to water resources and is able to sustain one or more approved post mining land uses (PMLUs). Give details of the consultation with regulators and the community about the intended PMLUs, the targets associated with their achievement, and how achievement of these targets may be hampered by, for example, site geology and climatic extremes.	Mine Closure and Rehabilitation Strategy
• If requested by regulators, specify and justify the methods and techniques that will be used to achieve particular rehabilitation targets and milestones. Explain how these methods may be constrained by project-specific features (e.g. topography, climate, geology and hydrology).	Not applicable
• If appropriate, describe how the effectiveness of the proposed rehabilitation methods and techniques for protecting or restoring water resources will be monitored, and present details (e.g. parameters, sampling frequency) of a monitoring program for demonstrating successful achievement of the targeted PMLUs across the project area after mining or CSG extraction has finished. These monitoring programs should be linked to explicit milestones for completion of progressive stages of rehabilitation, and should include appropriate baseline data against which to judge the effectiveness of the rehabilitation.	Section 12 and to be defined as part of detailed closure planning Mine Closure and Rehabilitation Strategy
• Describe the final landform and any voids that may remain after closure, and specify the predicted legacy impacts that may persist, such as ongoing effects on surface water and groundwater movements and water quality, erosion and sedimentation, and habitat fragmentation of water-dependent species and communities. Evaluate the adequacy of the modelling underlying these predictions, especially all sources of uncertainty.	Sections 2.2, 10, 12 and to be defined as part of detailed closure planning Mine Closure and Rehabilitation Strategy
• Assess qualitatively the likely long-term risks of impacts on water resources and water-dependent assets posed by various options for the final landform design, including complete or partial backfilling of mining voids. Assessment of the final landform for which approval is being sought should consider:	Sections 6.4, 10 Mine Closure and Rehabilitation Strategy
– Stability (e.g. resistance to erosion and slumping), soil geochemistry and quality (relevant for post-closure establishment of vegetation) and the likely effects of the final landform on long-term surface water and groundwater behaviour (e.g. fluxes and runoff) and on water quality, including salinity, pH, toxicity and concentrations of contaminants.	Section 10 Annexure B Mine Closure and Rehabilitation Strategy
– Geochemistry and its potential effects on seepage through waste rock (e.g. fully or partially refilled voids, remnant rock dumps) and on the quality of water exiting from mine adits and other post-closure sources.	Sections 4.7, 10 And to be defined as part of detailed closure planning

Assessment category	Section addressed
– Groundwater behaviour and rate and depths of watertable recovery, including timeframe and final levels of stabilisation.	Section 10
– Available measures (and their likely effectiveness and feasibility) to avoid or mitigate legacy impacts from the final landform and any voids on water resources and water-dependent assets.	Section 12
Baseline data	
• For groundwaters, surface waters and ecological water-dependent assets that have been identified in the risk-based assessment, present data that are sufficient to establish pre-development (baseline) conditions and that have been collected at an appropriate sampling frequency and spatial coverage of monitoring sites, ideally over a period sufficiently long to characterise the impacts of climatic variability.	Section 4 Annexure A Annexure B Annexure C MNES reports (Umwelt 2026a and 2026b)
Groundwater	
• Provide data from surveyed boreholes to demonstrate the varying depths of the hydrogeological units and associated standing water levels or potentiometric heads, including directions of groundwater flow, contour maps and hydrographs.	HVO Water Management Plan and annual reviews
• Present information from site-specific studies (e.g. geophysical, coring/wireline logging) to characterise the local stress regime and fault structure (e.g. damage zone size, open/closed along fault plane, presence of clay/shale smear, fault jogs or splays).	Discussed in Annexure A
• Provide site-specific values for hydraulic parameters (e.g. vertical and horizontal hydraulic conductivity and specific yield or specific storage characteristics, including the data from which these parameters were derived) for each relevant hydrogeological unit. In situ observations of these parameters should be sufficient to characterise the heterogeneity of these properties for modelling.	Section 4.6 Annexure A
• Provide hydrochemical characterisation (e.g. acidity/alkalinity, electrical conductivity, metals and major ions) and a suitable suite of environmental tracers (e.g. heat; stable isotopes of water; tritium, helium, strontium isotopes) (e.g. Kurukulasuriya et al. 2022; OWS 2020) commensurate with the risks of the proposed development to water resources and water-dependent assets.	Section 4.6 Annexure D HVO Water Management Plan and annual reviews
• Provide sufficient data on physical aquifer parameters and hydrogeochemistry to establish pre-development conditions, including fluctuations in groundwater levels at time intervals relevant to aquifer processes. This should include time-series data for water levels and water quality that represent seasonal and climatic cycles.	Section 4 Annexure A Annexure D HVO Water Management Plan and annual reviews
• Provide long-term groundwater monitoring data, including a comprehensive assessment of all relevant chemical parameters to inform changes in groundwater quality and detect potential contamination events.	Section 4 Annexure D HVO Water Management Plan and annual reviews
Surface water	
• Provide data for the hydrological regime of all watercourses, standing waters and springs across the site, including: – Spatial, temporal and seasonal trends in streamflow and/or standing water levels. – Spatial, temporal and seasonal trends in water quality data (such as turbidity, acidity, salinity, relevant organic chemicals, metals, metalloids and radionuclides).	Section 4 Annexure B HVO Water Management Plan and annual reviews

Assessment category	Section addressed
Ecology	
• Provide clear statements of the goals of the baseline data, specifying how the information will address knowledge gaps (e.g. current ecological condition of water-dependent assets in the project area, potential impact pathways) and justifying the choice of parameters and measures.	Discussed in Annexure C and MNES reports (Umwelt 2026a and 2026b)
• Describe and justify the sampling program (e.g. sampling frequency, locations of impact and control sites) and collection methods for gathering appropriate baseline data on all ecological water-dependent assets that have been identified in the risk-based assessment. The data and methods used may also help address information gaps in the IPDs and be used to monitor responses to predicted impacts of the development and the effectiveness of mitigation measures.	Section 4.8 Annexure C MNES reports (Umwelt 2026a and 2026b)
• Ensure ecological sampling methods reflect best practice, are quantitative if needed, and comply with relevant state or national monitoring guidelines (e.g. Queensland Government (2015) for sampling stygofauna). Identify plants and animals (including stygofauna and aquatic invertebrates) to the lowest feasible taxonomic resolution to optimise the value of the baseline data. Where possible, make baseline data publicly available.	Annexure C
• Identify potential aquatic and terrestrial GDEs, using the method outlined by Eamus et al. (2006) and information from the GDE Toolbox (Richardson et al. 2011), the GDE Atlas (CoA 2023) and the GDE Explanatory Note (Doody et al. 2019).	Annexure C
• Present information on the distribution of potential aquatic and terrestrial GDEs within and near the project area, and explain how their groundwater dependence has been ground-truthed and on which hydrogeological units they are likely to depend (see Doody et al. 2019).	Section 4.8 Annexure C
Monitoring and management	
• Describe the rationale for selected monitoring parameters and their sampling duration, frequency and methods, including the use of satellite or aerial imagery to identify and monitor large-scale impacts. Target monitoring programs to address key areas of uncertainty, especially for valued assets and water resources that are at greater risk of impacts from the proposed development.	Section 4 Annexure B HVO Water Management Plan
• Ensure water quality monitoring complies with relevant National Water Quality Management Strategy guidelines (ANZG 2018) and relevant legislated state protocols (e.g. Queensland Government 2018).	Annexure B HVO Water Management Plan
• Identify and justify monitoring sites representative of the diversity of potentially affected water-dependent assets and the nature and scale of potential impacts. Match suitably replicated control and reference sites (BACI design, Downes et al. 2002) to enable detection and monitoring of potential impacts.	Annexure C MNES reports (Umwelt 2026a and 2026b)
• Describe the processes employed to determine impact thresholds for water-dependent assets (e.g. threshold at which a significant impact on an asset may occur).	Section 4.8, 6 Annexure C
• Describe proposed mitigation and management actions, and their adequacy, for each significant impact identified, including any proposed mitigation or offset measures for long-term impacts post mining.	Sections 2, 6, 12 MNES reports (Umwelt 2026a and 2026b)
• Identify modifications or alternatives to avoid, minimise or mitigate potential cumulative impacts, and provide evidence of the likely success of these measures (e.g. case studies).	Sections 2, 6, 12 Annexure C
• Propose adaptive management measures and management responses, giving details of trigger action response plans (TARPs) for valued assets and water resources that are at greater risk of impacts from the proposed development.	Section 12 HVO Water Management Plan

Assessment category	Section addressed
Groundwater	
• Describe a robust groundwater monitoring program using dedicated groundwater monitoring bores – including nested arrays where there may be connectivity between hydrogeological units – and targeting specific aquifers, providing information on the groundwater regime and on recharge and discharge processes and identifying changes in quantities and quality of groundwater over time.	Sections 4, 12 HVO Water Management Plan
• Where reinjection schemes are proposed to manage wastewater (e.g. managed aquifer recharge), the monitoring program should include components specifically targeted at identifying any potential impacts from this management action.	Not applicable
Surface water	
• Identify and justify dedicated sites to monitor hydrology, water quality, and channel and floodplain geomorphology before, during and for a suitable period after the proposed development.	Sections 4, 12 Annexure B HVO Water Management Plan
• Describe a surface water monitoring program that will collect sufficient data to detect and identify the cause of any changes from established baseline conditions, and assess the effectiveness of mitigation and management measures. The program should: – Include baseline monitoring data for physico-chemical parameters, as well as contaminants (e.g. metals). – Compare physico-chemical data to national/regional guidelines or to site-specific guidelines derived from reference condition monitoring if available. – Identify baseline contaminant concentrations and compare these to national guidelines, allowing for local background correction (e.g. bioavailability) if required.	Section 12 Annexure B HVO Water Management Plan and annual reviews
Ecology	
• Provide clear statements of the goals of the monitoring program, specifying how the information will address knowledge gaps about, for example, changes in abundance, composition and condition of ecological water-dependent assets in and near the project area. Ensure that the monitoring program is powerful enough to detect relevant changes that indicate significant impacts or where management and mitigation measures are not working as predicted.	Discussed in Section 12 Annexure C MNES reports (Umwelt 2026a and 2026b) HVO Water Management Plan
• Describe and justify the monitoring program (e.g. sampling frequency, locations of impact and control sites) and collection methods for gathering appropriate monitoring data on all ecological water-dependent assets that have been identified in the risk-based assessment. Where possible, match the methods to those used in the baseline surveys so that the data are directly comparable and can be used to monitor responses to predicted impacts of the development and the effectiveness of mitigation measures.	Discussed in Sections 4, 12 Annexure C MNES reports (Umwelt 2026a and 2026b) HVO Water Management Plan
• Ensure that all proposed ecological monitoring uses standard sampling methods that reflect best practice and are quantitative if needed. Identify plants and animals (including stygofauna and aquatic invertebrates) to the lowest feasible taxonomic resolution to optimise the value of the monitoring data, and strive to make these data publicly available.	Discussed in Section 12 Annexure C MNES reports (Umwelt 2026a and 2026b) HVO Water Management Plan (which will be updated in future)

Assessment category	Section addressed
• Describe how the monitoring data will be analysed and reported, specifying how the information will feed back into regular assessment of whether (and where) impacts are occurring and whether mitigation measures are being effective. Ensure that this information is explicitly linked to TARPs that guide adaptive management of impacts of the proposed development on ecological water-dependent assets in and near the project area during and for a suitable period after the proposed development.	Discussed in Section 12 Annexure C MNES reports (Umwelt 2026a and 2026b) HVO Water Management Plan (which will be updated in future)
• Specify and justify all proposed management and mitigation measures to protect ecological water-dependent assets that were identified in the risk-based assessment. Present relevant evidence to demonstrate the likely effectiveness of these measures. Specify how the data to be collected in the monitoring program will illustrate the effectiveness of these management and mitigation measures, and present relevant TARPs describing this adaptive management.	Discussed in Section 12 Annexure C MNES reports (Umwelt 2026a and 2026b) HVO Water Management Plan (which will be updated in future)
Cumulative impacts	
• Assess the condition and likely responses of all water-dependent assets and water resources likely to be cumulatively impacted by the proposed development combined with all developments (past, present and/or reasonably foreseeable) and other water-intensive activities.	Sections 6.7, 7, 8, 9, 10 Annexure A Annexure B Annexure C
• Assess the cumulative impacts on potentially affected water-dependent assets and water resources, considering: – The full extent of potential impacts from the proposed project (including whether there are alternative options for infrastructure and mine configurations which could reduce impacts). – All stages of the development, including exploration, operations and post-closure/rehabilitation. – The likely spatial magnitude and timeframe over which cumulative impacts will occur (ensuring that the analysis has sufficiently broad geographic and temporal boundaries to include all potentially significant impacts). – Opportunities to work with other water users to avoid or mitigate potential cumulative impacts to meet specified environmental objectives.	Sections 7, 8, 9 and 10 Annexure A Annexure B Annexure C